REMARKS

Claims 2-22 are now pending in this application. Claim 1 is rejected. Claim is cancelled herein. New claims 2-22 are added to express the invention in alternative wording, broaden language as deemed appropriate and to address matters of form unrelated to substantive patentability issues. Other formal matters are attended to that were not addressed by the Examiner and accordingly are considered unrelated to substantive patentability issues.

PARAGRAPH FOR SUBSTITUTE SPECIFICATION AND ABSTRACT

The specification is objected to due to a misspelling. Applicant submits herewith a substitute specification and abstract wherein amendments are effected to place the text thereof into proper English in accordance with 37 CFR 1.125(c). Also accompanying this amendment is a reproduction of the original specification and abstract with markings indicating the amendments effected in the substitute specification in accordance with MPEP §608.01(q) and 37 CFR 1.125(b). No new matter is added. Entry of the substitute specification and abstract is respectfully requested.

CLAIM REJECTIONS UNDER 35 U.S.C. §103(a)

Claim 1 is rejected as obvious over the Kim reference in view of Ahuha under 35 U.S.C. §103(a). Claim 1 is now cancelled rendering the rejection moot. However, insofar as the subject matter of new claims reflects that of the cancelled claim 1 and in the event the Examiner considers asserting the present rejection against the new claims or making the next Office Action final, applicants submit the following remarks.

It is respectfully submitted that a *prima facie* case of obviousness was not established in the case of now-cancelled claim 1 and cannot be established to reject new claims 2-22. "To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on the applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991)." MPEP §706.02(j) "Contents of a 35 U.S.C. §103 Rejection".

The Examiner asserts that the Kim reference teaches all claim elements with

the exception of the "minute current generator" and turns to the Ahuja reference for providing such a teaching. It is respectfully submitted that the Examiner has misinterpreted the references in several respects and that the references fail to show, *inter alia*, the features noted below.

The application of the Kim reference to prior claim 1 is first addressed because it appears that various aspects of the reference are misconstrued. In the rejection of original claim 1, the Examiner states that the Kim references shows "a zero sequence current transformer (element 710 in Fig. 7) detecting abnormal current flow generated by ground faults or leakage currents." However, configuration of the Kim circuit detects overload current as clearly stated in the reference and as evident since the "zero current transformer" is not wired as such. It includes only the load line as the primary winding and therefore senses only overload currents. Furthermore, the Examiner states that a comparison is made with " the standard set-point value (reference voltage input +26V)." In actuality, the 26V is the power supply voltage 26V and not a reference voltage.

Of greater significance is the treatment of the previously claimed feature of claim 1 "a cut-off/reset controller operating a relay in the case of the ground faults or the leakage currents, or resetting the relay in the case of elimination of the causes of the leakage currents." This feature corresponds to the broadened recitation in claim 2 of the following:

> a controller for controlling said power cutoff device to effect interruption of power flow and institution of the test current in said power conduction paths in response to said abnormality detection output indicating an abnormality and end said interruption of power flow in response to said abnormality detection output ceasing indicating the abnormality based on said test current.

In rejecting claim 1 the Examiner states that the Kim reference shows "a cut-off/reset controller (block 530 in Fig. 9) operating a relay (element 108 in Fig. 1) in the case of the ground faults or the leakage currents, or resetting the relay in the case of elimination of the causes of the leakage currents (col. 8, line 53 - col. 9, line3)."

It is important to note that the present invention resets the power interuption in response to the "abnormality detection output ceasing indicating the abnormality based on said test current." (Cancelled claim 1 phrased this more narrowly as "resetting the relay in the case of elimination of the causes of the leakage currents.") This feature is clearly absent in the Kim reference. The cited portion of the Kim patent references an "auto reset circuit" but fails to teach that the auto reset is controlled by testing for an abnormality, for example a leakage current, after power is interrupted and reapplying power in response to the abnormality ceasing.

The Examiner conjectures that Kim "implicitly discloses an auto reset unit supplying a pulse to check an input signal after the cut-off/reset controller is

operated to cut off the abnormal current flow (OLCI SET and OLCI RESET signals supplied by such unit)." The Examiner further states:

> As a matter of fact, Kim et al. reference implicitly disclosed checking the fault status of the system (through use of block 780 in Fig. 7) but it did not disclose these checks being performed periodically.

However, the Examiner's analysis fails to state that the circuit is reset in response to an abnormality ceasing which is the subject matter of the claim.

The Examiner's attention is directly to the following text of column 14 of the Kim patent detailing control of the block 780:

> In the case where an overload is not detected in the OLCI 700, the voltage level of the OLCI RESET signal is equal to that of the OLCI SET signal. In this case, if the value of the resistors R43, R44, R45 are established to operate the transistor Q5 according to the OLCI SET signal, the voltage VCE between the collector and the emitter of the transistor Q5 equals approximately zero. Therefore, the transistor Q4 turns off and the capacitors C4, C37 of the integrator 740 can charge the overload voltage. On the other hand, when overload is detected in the OLCI 700, the display panel 800 indicates overload detection. When a current enters in the display panel 800 indicating an overload or some other fault, the voltage level of the OLCI RESET signal is greater than that of the OLCI SET signal. Therefore, the transistor Q5 turns off and the transistor Q4 turns on via the OLCI RESET signal. So, the charged voltage in the capacitors C4, C37 is discharged through the transistor Q4.

Thus, only in response to an overload being detected is the OLCI RESET signal activated by the display panel 800. Accordingly, in Kim resetting is done to connect power to the load without determining whether the abnormality is eliminated since there is no means for providing a test current to the load other than the full line power, which would not produce a "test current." This deficiency is confirmed by the Examiner's statement that Kim " does not disclose a minute current generator and auto-reset unit."

The Examiner references the Ahuja reference for allegedly teaching a "minute current generator." However, a "minute current generator," or the currently claimed "a test current feed device for feeding a test current in at least one of said power conduction paths" is clearly not present in the Ahuja reference. When the relay 16 is opened a test current cannot flow in the power conduction path because the relay 16 is in series with the current sensing resistor 18 and opens the path preventing flow. The circuit of the reference, as in the Kim circuit, merely keeps reapplying line potential rather then first testing for elimination of the fault. In short neither reference teaches the application of a test current to determine if an abnormality is gone before reapplying power. Hence, the references cannot teach nor render obvious the claimed feature of ending "said interruption of power flow in response to said abnormality detection output ceasing indicating the abnormality based on said test current."

Thus, it is respectfully submitted that the rejected claim was not obvious in view of and the new claims cannot be render obvious by the cited references for the reasons stated above. Accordingly, allowance of the claims is respectfully requested.

NEXT ACTION CANNOT BE MADE FINAL

It is further noted that the above discussed features present in the originally filed claim were not taught by the references. As such, the present amendments cannot necessitate new grounds for rejection as the present rejections are respectfully submitted as failing to have been established. Accordingly, it is respectfully submitted that a next Office Action cannot be made final.

CLAIM FEES

One claim in excess of twenty is added. Accordingly, please charge the fee of $50.00 to Deposit Account No. 10-1250.

REQUEST FOR EXTENSION OF TIME

Applicant respectfully requests a two month extension of time for responding to the Office Action. Please charge the fee of $450.00 for the extension of time to Deposit Account No. 10-1250.

If there is any discrepancy between the fee(s) due and the fee payment authorized the USPTO is hereby authorized to charge any fee(s) or fee(s) deficiency or credit any excess payment to Deposit Account No. 10-1250.

In light of the foregoing, the application is now believed to be in proper form for allowance of all claims and notice to that effect is earnestly solicited.

Respectfully submitted,
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enc: Substitute Specification; and Marked reproduction of original specification.

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

The present invention relates to an auto-reset leakage current circuit breaker having function of an over current limiter cutting off a power supply in the case of over current flows, having function of a leakage current circuit breaker cutting off an electric path automatically in the incidence of ground faults or leakage currents, and resetting ~~these both~~ both these functions after the elimination of the above causes.

DESCRIPTION OF THE RELATED ART

Generally, in electric power distribution lines of low voltage, an ~~over current~~ overcurrent limiter and a leakage current circuit breaker are installed separately and independently. When an ~~over current~~ overcurrent ~~is flowed~~ flows in an electric path beyond [[the]] a standard set-point value, the ~~over current~~ overcurrent limiter is operated to cut off the power supply to protect electrical machinery and apparatus. ~~In more,~~ Furthermore, when an abnormal current flow is generated by a ~~lighting~~ lightning flash to earth, surge or power leakage, the leakage current circuit breaker is operated to cut off the electric path.

However, the abnormal current detector of the present leakage current circuit breaker is generally a zero (phase) sequence current transformer.

Generally, [[the]] a wave shape of ~~the~~ a power supply is normal. However, ~~the~~ causes[[,]] such as a ~~lighting~~ lightning flash to earth, surge or power leakage, makes the wave shape of the power supply abnormal. When the wave shape of the power supply is normal, the zero sequence current transformer does not generate [[the]] a secondary output. However, when the wave shape is abnormal, the zero sequence current transformer generates the secondary output. The problem is that the present leakage current circuit breaker is operated in the case of not only power leakage but also ~~lighting~~ lightning flash to earth or surge.

~~In more~~ Additionally, after the cause that has operated the leakage current circuit breaker [[has]] is eliminated, function of the leakage current circuit breaker is not reset to supply the electric power again. Therefore, ~~some one~~ someone goes to the place where the leakage current circuit breaker is ~~placed~~ and has to reset function of the leakage current circuit breaker manually.

As a result, it often requires too much effort and time to reset function of the leakage current circuit breaker, when leakage current circuit breakers are installed in mobile telecommunication repeaters or unmanned electric equipment placed in rooftop of buildings or up-country, or street lamps placed in far distance among them.

SUMMARY OF THE INVENTION

The purpose of the present invention is to provide an auto-reset leakage current circuit breaker performing functions of cutting off ~~over current~~

overcurrent flows and leakage current flows, and having a compact size installed easily in a narrow space.

The other purpose of the present invention is to provide an auto-reset leakage current circuit breaker resetting it's function again after eliminating the causes, such as a ~~lighting~~ lightning flash to earth, surge or power leakage, that have generated abnormal current flows to operate the leakage current circuit breaker.

To overcome the above described problems, preferred embodiments of the present invention provide an auto-reset leakage current circuit breaker performing an ~~over-current~~ overcurrent cut-off function, a leakage current cut-off function, and a reset function, and comprising: a zero sequence current transformer detecting abnormal current flows generated by ground faults or leakage currents; an abnormal current detector comparing [[the]] a value of the abnormal current flows, detected by the zero sequence current transformer, with [[the]] a standard set-point value; a cut-off/reset controller operating a relay in the case of [[the]] ground faults or [[the]] leakage currents, or resetting the relay in the case of elimination of the causes of the leakage currents; the relay cutting off or resetting an electric path by the order of the cut-off/reset controller; a minute current generator supplying minute currents to check leakage states, until the causes of the leakage current is eliminated, after the relay cuts off the electric path; and an auto-reset unit supplying a pulse periodically to check an input signal after the cut-off/reset controller is operated to cut off the abnormal current flows.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention and the advantages thereof, reference is now made to the following descriptions taken in conjunction with the accompanying drawings, in which like reference numerals denote like parts, and in which:

Fig. 1 is a block diagram of an auto-reset leakage current circuit breaker according to the present invention;

Fig. 2 is a ~~detail~~ circuit ~~diagram~~ schematic of the auto-reset leakage current circuit breaker of Fig. 1; and

Fig. 3 is a front view of the auto-reset leakage current circuit breaker of Fig. 1.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Reference will now be made in detail to preferred embodiments of the present invention, example of which is illustrated in the accompanying drawings.

Fig. 1 is a block diagram of an auto-reset leakage current circuit breaker according to the present invention, Fig. 2 is a ~~detail~~ circuit ~~diagram~~ schematic of the auto-reset leakage current circuit breaker of Fig. 1, and Fig. 3 is a front view

of the auto-reset leakage current circuit breaker of Fig. 1.

The auto-reset leakage current circuit breaker of the present invention has a compact size with 7 cm in length, 16 cm in width, and 7 cm in thickness approximately shown in Fig. 3, and wires varistors to comprise a surge bypass device 110 for bypassing a surge, caused by a ~~lighting~~ lightning flash to earth, [[etc.]] e.g., to the ground, and an ~~over current~~ overcurrent limiter 100 cutting off ~~over current~~ overcurrent flows to protect electrical machinery, apparatus or lines.

~~In more, the~~ The auto-reset leakage current circuit breaker comprises a zero sequence current transformer 220, an abnormal current detector 230, [[an]] a cut-off/reset controller 240, a relay 250, a minute current generator 260, and an auto-reset unit 270. The zero sequence current transformer 220 detects abnormal current flows caused by ground fault or leakage current flows of electrical machinery or apparatus. The abnormal current detector 230 checks whether the value of the abnormal current flows detected by the zero sequence current transformer 220 [[are]] is beyond the standard set-point value or not, or checks whether the value of the current flows ~~recovered~~ after eliminating the cause of leakage current flows [[are]] is below the standard set-point value or not.

Additionally, the cut-off/reset controller 240 operates the relay 250 when a ~~lighting~~ lightning flash, surge, or power leakage ~~are happened~~ occurs, or orders a control signal to the relay 250 to reset functions of the relay 250 after eliminating the cause of power leakage. The relay 250 performs function of cutting off or resetting the power supply according to the control signal from the

cut-off/reset controller 240. Until eliminating the cause of the interruption after the electric current flow is cut off by the relay 250, the minute current generator 260 supplies a minute electric current, i.e. test current, to recognize leakage states. After the leakage current flows are cut off by occurrence of the abnormal current flows, the auto-reset unit 270 supplies pulses periodically to make the abnormal current detector 230 compare an input signal with the standard set-point value sequentially.

Preferable operation procedures of the present invention are described in the following statements,

As described in the above statements, it is known publicly that [[the]] an ~~over current~~ overcurrent limiter cuts off the power supply to protect electrical machinery or apparatus when ~~over current~~ overcurrent flows are generated. Therefore, the ~~over current~~ overcurrent limiter will not be described in detail in this discloser. On the contrary, this ~~discloser~~ disclosure will describe function and operation procedures of the auto-reset leakage current circuit breaker cutting off or resetting the power supply automatically, when the leakage causes, such as a ~~lighting~~ lightning flash to earth, ground faults, or leakage currents, are generated or eliminated.

Fig. 2 illustrates operation procedures of the leakage current circuit breaker connected electrically with the over current limiter. The zero sequence current transformer 220 detects abnormal currents flows generated by the leakage causes, such as a ~~lighting~~ lightning flash to earth, ground faults or leakage currents.

When [[the]] a value of the abnormal current flows, detected by the zero sequence current transformer 220, is lower than the standard set-point value of the abnormal current detector 230 comprising an integrated circuit (IC) U1, a transistor Q1 and condensers C1 to C3 and C12, the leakage current circuit breaker is not operated. However, when the value of the abnormal current flows is higher than the standard set-point value, it will be recognized by the cut-off/reset controller 240, comprising an integrated circuit (IC) U2, transistors Q2 and Q3, diodes D1 and D2, resistances R9 to R12, a condenser C6, and relays K1 and K2, connected electrically with the abnormal current detector 230. Sequentially, the cut-off/reset controller 240 operates a cut-off signal input circuit 221.

Therefore, in the cut-off signal input circuit 221, a relay switch [[K2-No]] K2-NO connected with the resistance R1 is turned on. Simultaneously, a reset signal input circuit 222 is turned off, and the relay 250 is operated to cut off the electric path. When the electric path is cut off, a light emitting diode LED1 connected [[with]] to the cut-off/reset controller 240 is turned on, and a light emitting diode LED2 connected [[with]] to the load end is turned off. Therefore, diodes LED1 and LED2 show that the electric path is cut off and the electric power is not supplied. Accordingly, these diodes make an operator recognize easily whether electric currents flow or not.

~~In more, when~~ When the relay 250 is operated, the minute current generator 260, connected with the relay 250 in parallel and comprising a condenser CIO and a resistance R13, supplies minute currents to the load end continuously to detect the leakage status of the electric path.

On the contrary, when the leakage causes, such as ground faults, are eliminated, the auto-reset unit 270 comprising an integrated circuit (IC) U2, resistances R5 and R6, and a condenser C4 generates a launch signal. Sequentially, when the value of the abnormal current detected by the zero sequence current transformer 220 is lower than the standard set-point value in the abnormal current detector 230, the cut-off/reset controller 240 connected with the abnormal current detector 230 resets the function of the relay 250 to the original states.

Therefore, the relay switch [[K2-No]] K2-NO of the [[cut-ff]] cut-off signal input circuit 221 is turned off, the relay switch [[K2-Nc]] K2-NC of the reset signal input circuit 222 is turned on, and the relay 250 is reset. ~~In more~~ Furthermore, the diode LED1 connected with the [cut-ff]] cut-off/reset controller 240 is turned off, and the diode LED2 connected with the load end is turned on. As a result, the diodes LED 1 and LED2 show that the electric path have been reset automatically.

As described in the above statements, while the ~~over current~~ overcurrent limiter protecting electrical machinery and apparatus from ~~over current~~ overcurrent flows is reset manually like the way of the conventional method, the leakage current circuit breaker ~~cutting~~ of the present invention cuts off the electric path in the case of abnormal current flows, such as ground faults or leakage currents, and is reset automatically [[in the]] by withdrawal of causes of [[the]] abnormal current flows.

Therefore, to reset the function of the leakage current circuit breaker, the

operator of an electrical machinery and apparatus rarely goes to the place where the leakage current circuit breaker is installed. In more, the auto-reset leakage current circuit breaker of the present invention has the over current limiter and the leakage current circuit breaker together in a compact size so that it is easy to be installed even in a narrow space. As a result, it is effective for an operator to manage such electrical machinery and apparatus with the auto-reset leakage current circuit breaker of the present invention.

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention.

ABSTRACT OF THE DISCLOSURE

~~The present invention discloses an~~ An auto-reset leakage current circuit breaker ~~performing~~ perform an over current cut-off function, leakage current cut-off function, and reset function[[,]]. ~~and comprising~~ The circuit breaker has a zero sequence current transformer detecting abnormal current flows ~~generated by ground faults or leakage currents~~, an abnormal current detector comparing [[the]] a value of the abnormal current flows, ~~detected by the zero sequence current transformer~~, with [[the]] a standard set-point value, a cut-off/reset controller operating a relay to cut off the electric path in the case of ~~the ground faults or the leakage currents,~~ an abnormal current flow or resetting the relay in the case of elimination of the causes of the ~~leakage currents, the relay cutting off or resetting an electric path by the order of the cut-off/reset controller, a minute~~ abnormal current flow. A test current generator ~~supplying minute~~ applies test currents to check leakage states~~, until the causes of the leakage current is eliminated,~~ after the relay cuts off the electric path, and an auto-reset unit supplying a pulse periodically to check ~~an input~~ a current transformer signal after the cut-off/reset controller is operated to cut off the abnormal current flows.